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A.D. 1875, 39<sup>th</sup> MAY.

N<sup>o</sup> 1972.

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SPECIFICATION

OF

DANIEL WILKS.

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COLLECTING AND TREATING SEWAGE.

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LONDON:

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1875.







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A.D. 1875, 29th May. N° 1972.

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## Collecting and Treating Sewage.

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LETTERS PATENT to Daniel Wilks, of Bloxwich, in the County of Stafford, Sanitary Engineer, for the Invention of “IMPROVEMENTS IN COLLECTING, RECEIVING, AND TREATING THE VEGETABLE AND ANIMAL REFUSE AND SEWAGE OF LARGE TOWNS, AND IN TREATING THE SAME FOR THE MANUFACTURING OF MANURE AND THE PRODUCTION OF A FINE CARBONACEOUS POWDER TO BE USED AS AN AGENT FOR FILTERING SEWAGE WATER, HOUSE DRAINS, AND OTHER OBNOXIOUS FLUIDS, AS WELL AS ABSORBING AND DEODORIZING EXHALATIONS FROM WATERCLOSETS, URINALS, AND OTHER PLACES, AND IN THE MEANS EMPLOYED THEREIN, AS ALSO THE APPLICATION OF THE AFORESAID POWDER TO THE PRESERVATION OF FOOD.”

Sealed the 16th November 1875, and dated the 29th May 1875.

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PROVISIONAL SPECIFICATION left by the said Daniel Wilks at the Office of the Commissioners of Patents, with his Petition, on the 29th May 1875.

I, DANIEL WILKS, of Bloxwich, in the County of Stafford, Sanitary  
5 Engineer, do hereby declare the nature of my said Invention for “IMPROVEMENTS IN COLLECTING, RECEIVING, AND TREATING THE VEGETABLE AND ANIMAL REFUSE AND SEWAGE OF LARGE TOWNS, AND IN TREATING THE SAME FOR



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THE MANUFACTURING OF MANURE AND THE PRODUCTION OF A FINE CARBONACEOUS POWDER TO BE USED AS AN AGENT FOR FILTERING SEWAGE WATER, HOUSE DRAINS, AND OTHER OBNOXIOUS FLUIDS, AS WELL AS ABSORBING AND DEODORIZING EXHALATIONS FROM WATERCLOSETS, URINALS, AND OTHER PLACES, AND IN THE MEANS EMPLOYED THEREIN, AS ALSO THE APPLICATION OF THE AFORESAID POWDER TO THE PRESERVATION OF FOOD," to be as follows (that is to say) :— 5

My improvements in collecting animal and other refuse consist in special arrangements for position and condition of domestic receivers, as for instance, the soap suds, liquor in which vegetables have been cooked, and other refuse fluids carried off by the usual domestic sinks. 10 I purpose utilizing by the use of a compound filter and stink trap arranged for intercepting the solid matter or particles floating in such domestic refuse, so that the same may be recovered at stated times, whilst the fluid becomes purified before entering the drain or local outfall, without being deleterious to any river or watercourse into which 15 it may fall, this collected solid matter or particles will be referred to hereafter.

This same apparatus is applicable to public urinals, slaughter-houses, stables, cattle sheds, pig-styes, and other like places, the operation being that before the urine or other fluids from such places can flow away it 20 passes through an ascending filter, thereby depositing all its fertilizing properties for subsequent utilization, allowing the water thus filtered or purified to flow away in a non-injurious condition. The deposit thus made by the process of filtration I purpose collecting and treating as hereafter described for the manufacture of manure. 25

In applying my improvements for the maintaining the healthy sanitary condition of large towns or communities, I adopt (by preference) what is known as the intercepting principle, and so construct the receiver that the urine deposited may be filtered and carried away, leaving the fertilizing qualities behind with the solid matter to be 30 removed to a suitable depôt when required. These deposits so collected I purpose storing or placing in a suitable receiver, that the natural process of fermenting and solidifying such matter may proceed aided by a process hereafter described.

In treating sewage matter I purpose erecting at the outfall a suitable 35 series of filtering tanks, which I purpose covering over to prevent exhalation, applying my improved upward filtering system to such tanks



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that the water draining over the bar of the subsiding tanks will fall down and rise up through my special filtering arrangement before it escapes into the common channel to flow to the river or brook; thus no water can possibly escape until it is thoroughly pure, while the sludge  
5 that has subsided in the said tanks I remove in rotation to an elevated receiver, which I also purpose arranging with a suitable cover; and when the sludge is sufficiently dry, this tank may be tapped and the partly dried sludge by the force of gravitation will descend and be deposited on a suitable floor to be utilized as hereafter described.

10 Through all the means and processes herein-before described I purpose using largely a powerful absorbing carbonaceous powder, which has the quality not only of deodorizing, but also the absorption of all remaining moisture. This powder I manufacture from surface refuse, such as stale vegetables, collections and sweepings from streets and markets with the  
15 animal manure, together with ashes, which may be collected from house refuse; thus this essential element of my Invention is unlimited in its supply. The refuse thus mentioned I place in a suitable kiln or otherwise, and burn until the whole entire mass has been calcined or thoroughly burned and reduced to a fine powder, which may be further  
20 treated by sieving. The powder is an absolute and complete absorber and deodorizer; therefore in preparing my filtering bed or beds, whether for domestic sinks, private or public urinals, or lavatories, slaughter-houses, sewage outfalls of large towns or otherwise, I purpose using this powder largely, so that when collecting the deposit from any of these  
25 situations, its use has the effect of absorbing all foul exhalations, offensive odour or smell, and rapidly absorbing moisture from which such exhalations arise, as also when commingled with the excretions or other matter becomes an essential element in reducing this matter to a suitable condition for manure; so also its utility is invaluable in the  
30 general treatment of sewage, and renders the use of lime as a precipitate unnecessary.

In practice I may say that the subsiding tanks herein-before described may be provided with a porous covering, such as cocoa-nut matting or other material, on which I distribute a layer of the aforesaid deodorizing  
35 powder, and again I apply this to the elevated sludge tanks which prevents all obnoxious exhalations, and when the said sludge tanks are in condition to be emptied as before described, by allowing the sludge to descend on a drying floor, I prefer dredging the said sludge with this



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powder, and when sufficiently dried this sludge may be cut or divided up into suitable lumps or bricks, that will admit of being placed in an open form for heat to pass through them in a suitable drying kiln somewhat like the burning of bricks, the effect of which will be to dry and reduce such lumps or bricks to a condition, that they may be readily reduced to 5 a deodorizing and filtering powder, but if sewage matter thus treated be required for fertilizing purposes, I allow it to lie together in large quantities to ferment and prepare itself by natural means to the condition required, by which process ammonia and other gases are not evolved, but retained for their valuable qualities in such manure. 10

And lastly, I purpose utilizing my deodorizing and absorbing powder for the packing or reserving of eggs, fish, flesh, poultry, as well as fruit and vegetables, for which purpose it will be found invaluable, as by its absorbing properties it takes up all damp or moisture that may be in or about the food to be preserved, and from its fineness it will fill up every 15 void in and about the article or articles to be preserved, that when covered up by the outer protection (which may be an ordinary box or cask), no room will be left for air to occupy, which being thoroughly excluded, the composition will become a complete preserver, and be of great value in preserving fresh food for long voyages at sea, or for 20 innumerable other purposes where preserving is required.

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**SPECIFICATION** in pursuance of the conditions of the Letters Patent, filed by the said Daniel Wilks in the Great Seal Patent Office on the 29th November 1875.

**TO ALL TO WHOM THESE PRESENTS SHALL COME, I, DANIEL 25**  
**WILKS**, of Bloxwich, in the County of Stafford, Sanitary Engineer, send greeting.

**WHEREAS** Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Twenty-ninth day of May, in the year of our Lord One thousand eight hundred and seventy-five, in the 30 thirty-eight year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Daniel Wilks, Her special license that I, the said Daniel Wilks, my executors, administrators, and assigns, or such others as I, the said Daniel Wilks, my executors,



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administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the  
5 Channel Islands, and Isle of Man, an Invention for “IMPROVEMENTS IN COLLECTING, RECEIVING, AND TREATING THE VEGETABLE AND ANIMAL REFUSE AND SEWAGE OF LARGE TOWNS, AND IN TREATING THE SAME FOR THE MANUFACTURING OF MANURE AND THE PRODUCTION OF A FINE CARBONACEOUS POWDER TO BE USED AS AN AGENT FOR FILTERING SEWAGE WATER, HOUSE DRAINS, AND OTHER OBNOXIOUS  
10 FLUIDS AS WELL AS ABSORBING AND DEODORIZING EXHALATIONS FROM WATER-CLOSETS, URINALS, AND OTHER PLACES, AND IN THE MEANS EMPLOYED THEREIN, AS ALSO THE APPLICATION OF THE AFORESAID POWDER TO THE PRESERVATION OF FOOD,” upon the condition (amongst others) that I, the said Daniel Wilks, my executors, administrators, and assigns, by an instrument in writing  
15 under my or their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

20 NOW KNOW YE, that I, the said Daniel Wilks, do hereby declare the nature of my said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement, reference being had to the accompanying Drawings and to the letters and figures marked thereon, that is to say:—

25 My improvements in collecting animal and other refuse consist in special arrangements for position and condition of domestic receivers, as for instance the soapsuds, liquor in which vegetables have been cooked, and other refuse fluids carried off by the usual domestic sinks I purpose utilizing by the use of a compound filter and stink trap arranged  
30 for intercepting the solid matter or particles floating in such domestic refuse, so that the same may be recovered at stated times, whilst the fluid becomes purified before entering the drain or local outfall without being deleterious to any river or watercourse into which it may fall; this collected solid matter or particles will be referred to hereafter.

35 The same apparatus is applicable to public urinals, slaughter-houses, stables, cattle sheds, pig-styes, and other like places, the operation being that before the urine or other fluids from such places can flow away it



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passes through an ascending filter, thereby depositing all its fertilizing properties for subsequent utilization, allowing the water thus filtered or purified to flow away in a non-injurious condition. The deposit thus made by the process of filtration I purpose collecting and treating as hereafter described by the manufacture of manure. 5

In applying my improvements for the maintaining the healthy sanitary condition of large towns or communities I adopt (by preference) what is known as the intercepting principle, and so construct the receiver that the urine deposited may be filtered and carried away, leaving the fertilizing qualities behind with the solid matter to be removed to a suitable 10 depôt when required. These deposits so collected I purpose storing or placing in a suitable receiver that the natural process of fermenting and solidifying such matter may proceed, aided by a process hereafter described.

In treating sewage matter I purpose erecting at the outfall a suitable 15 series of filtering tanks, which I purpose covering over to prevent exhalation, applying my improved upward filtering system to such tanks that the water draining over the bar of the subsiding tanks will fall down and rise up through my special filtering arrangement before it escapes into the common channel to flow to the river or brook; thus no water 20 can possible escape until it is thoroughly pure, whilst the sludge that has subsided in the said tanks I remove in rotation to an elevated receiver, which I also purpose arranging with a suitable cover, and when the sludge is sufficiently dry this tank may be tapped, and the partly dried sludge, by the force of gravitation, will descend and be deposited on a 25 suitable floor to be utilized, as hereafter described.

Through all the means and processes before described I purpose using largely a powerful absorbing carbonaceous powder, which has the quality not only of deodorizing but also the absorption of all remaining moisture. This powder I manufacture from surface refuse, such as stale vegetables, 30 collections and sweeping from streets and markets, with the animal manure, together with ashes which may be collected from house refuse; this essential element of my Invention is unlimited in its supply. The refuse thus mentioned I place in a suitable kiln or otherwise, and burn until the whole entire mass has been calcined or thoroughly burned and 35 reduced to a fine powder, which may be further treated by sieving. This powder is an absolute and complete absorber and deodorizer; there-



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for in preparing my filtering bed or beds, whether for domestic sinks, private or public urinals or lavatories, slaughter-houses, sewage outfalls of large towns or otherwise, I purpose using this powder largely, so that when collecting the deposit from any of these situations its use has the  
5 effect of absorbing all foul exhalations, offensive odour, or smell, and rapidly absorbing moisture from which such exhalations arise; as also when commingled with the excretions or other matter becomes an essential element in reducing this matter to a suitable condition for manure; so also its utility is invaluable in the general treatment of  
10 sewage, and renders the use of lime as a precipitate unnecessary.

In practice I may say that the subsiding tanks herein-before described may be provided with a porous covering, such as cocoa-nut matting or other material, on which I distribute a layer of the aforesaid deodorizing powder, and again I apply this to the elevated sludge tanks, which  
15 prevents all obnoxious exhalations, and when the said sludge tanks are in condition to be emptied, as before described, by allowing the sludge to descend on a drying floor I prefer dredging the said sludge with this powder, and when sufficiently dried this sludge may be cut or divided up into suitable lumps or bricks that will admit of being placed in an open  
20 form for heat to pass through them in a suitable drying kiln somewhat like the burning of bricks, the effect of which will be to dry and reduce such lumps or bricks to a condition that they may be readily reduced to a deodorizing and filtering powder; but if sewage matter thus treated be required for fertilizing purposes I allow it to lie together in large  
25 quantities to ferment and prepare itself by natural means to the condition required, by which process ammonia and other gases are not evolved, but retained for their valuable qualities in such manure.

And, lastly. I purpose utilizing my deodorizing and absorbing powder for the packing or preserving of eggs, fish, flesh, poultry, as well as  
30 fruit and vegetables, for which purpose it will be found invaluable, as by its absorbing properties it takes up all damp or moisture that may be in or about the food to be preserved, and from its fineness it will fill up every void in or about the article or articles to be preserved, that when covered up by the outer projection (which may be an ordinary  
35 box or cask) no room will be left for air to occupy, which being thoroughly excluded the composition will become a complete preserver, and be of great value in preserving fresh food for long voyages at sea, or for innumerable other purposes where preserving is required,



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But in order that I may be practically understood as to the nature of my Invention, and the manner of carrying the same into effect, I will further elaborate the description by aid of the Drawings hereunto annexed, and to which I will now refer.

## DESCRIPTION OF DRAWINGS.

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Fig. 1 represents a top view of a common domestic sink marked A, surrounded at the back and end by the house wall marked B, so that the sink, as here shown, stands as it were in a corner. The sink is simply shown surrounded at the free front and end by wood framing, the end of which projects into the wall, the floor of the sink being laid 10 with brick quarries set in cement, which will be found economical and enduring; C is the ordinary cast-iron drain, which may be either fitted underneath with an ordinary stink trap or simply with a flow way, hereafter to be referred to; D is a reservoir conveniently placed on the outside of the wall B. This reservoir can be constructed of any suitable 15 material, but I have found galvanized iron to be economic and durable. I prefer a portion of the top or cover to be so constructed that a small part of it can be readily opened in order that chamber or other slops may be easily emptied in and the cover again closed; but this arrangement I have not shown, as it may be omitted or variously constructed 20 by easily removing a part of the permanent cover, which is exhibited at *a, a*. The open portion is fitted with a flange, as at *b, b, b, b*, set down, say, about two inches, more or less, from the top edge of the reservoir, and in this condition the reservoir may be readily cleaned out when occasion requires, to facilitate which I purpose fitting a loose plug 25 in the bottom, so that the mud or sediment may be removed; but when in use I (by preference) lay a galvanized wire frame on this open part, the said frame resting on the flanges before mentioned, marked *b*; and on this wire frame I purpose laying a coarse cocoa-nut or other thin matting, over which may be strewed a layer of my deodorizing compound 30 (hereafter to be more particularly referred to), which will absorb all effluvia or exhalations arising from the contents of the reservoir, in close proximity to which reservoir I place two filters, not that the number is arbitrary, as one may be used, but perhaps not so effectively as two or more, according to space or convenience that situation may offer. These 35 filters are marked E and F, and are constructed with internal perforated bottoms, which bottoms are represented in dotted lines marked *c, d*, and



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*e, f*; in Fig. 2, which exhibits a front view of the sink A, section of the parting wall B, and in end view the reservoir D and filters E and F. As before referred to the dotted lines *c, d*, and *e, f*, show the position of the false bottoms of the filters, which filters I purpose nearly filling with  
5 my purifying deodorizing powder.

The action of the sink will be best understood from following the directions as here stated. The fluid, whether from vegetable cooking, soapsuds, or other kitchen slops, is emptied on the sink and flows through the stink trap C (seen only in Figure 1, which is connected to  
10 a waste pipe marked *g* (partly shown in dotted lines), which pipe enters the reservoir D as close to the top as is convenient, and may be cut off there, or (by preference) carried down, as shewn by the dotted lines near the bottom, which will entirely prevent any exhalations escaping through the same, and render the stink trap before referred to  
15 unnecessary. In this view of the reservoir D I have represented the cover *a* as being also of galvanized iron; the deflected flanges for receiving the wire frame (before referred to) being shown in dotted lines marked *h, h*. The fluid contents of the reservoir flow down the pipe *k, k*, and enter the filter E below the internal perforated bottom *c, d*, in which  
20 filter it rises through the mass of purifying deodorizing compound to the top, and again descends through the pipe *l, l*, entering the second filter (as in the former case) below the perforated bottom, from whence it ascends through the mass of purifying compound with which this filter (as at E) has also been charged, and rises on the surfaces pure and  
25 limpid, being deprived of all putrescent matter with which it had been before mixed, and in this case escapes through the waste pipe *m*, which may be near the surface of the ground line marked *n*, from whence it may flow to any common watercourse in a pure and inoffensive condition, so that the water in the river or stream with which it commingles will  
30 not be poluted from such effluent tributaries. The filtration thus conducted may be regulated, or made more or less active, by partially closing the flow way in the descending pipe *k, k*, by applying to it a tap controlled (by preference) by a lever key, for as the poluted water poured down the sink is generally intermittent the action of the filters  
35 may be made sufficiently continuous by contracting the orifice in the manner described.

This same arrangement without the sink may be beneficially used in all situations where animals are herded together, such as cattle sheds



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stables, or pig-styes, slaughter-houses, and other places, such as washing establishments, public urinals, or urinals belonging to large establishments, the general construction being arranged of suitable capacity and concentrated for receiving deleterious fluids from different approximating sources. 5

For private urinals I have found a receptacle constructed as shewn in front and end view at Fig. 3, drawn to a scale of one inch to the foot (also made of galvanized iron) to answer well. The top may be made of any shape, and readily removed for applying my purifying deodorizing compound within, and these urinals may be emptied after the deodorizing compound becomes fully saturated with urine, to be utilized as hereafter explained, and the portable top as before stated) may be made in any other suitable way in one or more parts. 10

In applying my improvements to conserve the health and sanitary economy of large towns I adopt to the fullest extent convenient the intercepting principle, by keeping all fluids away from commingling with foecal deposits. In effecting which the details may be much varied, but the system I have found to answer I have exhibited in plan at Fig. 4, drawn to a scale of half an inch to the foot, which may be considered as being constructed for male and female users. 15 20

Fig. 5 is a vertical section of the closet taken through the dotted lines *o* and *p*, and Fig. 6 a similar section taken through the dotted lines *q* and *r*; but I will first describe the section Fig. 5, which is arranged and adapted for female use. The vessel or receiver *G* (as in the former case) I have made of galvanized iron, and which can be made with a solid bottom, and with an outflow pipe near the top, but I prefer adopting the plan herein exhibited. The said receiver *G* has a perforated bottom that the urine as deposited may permeate the purifying compound (of which the vessel may be nearly full), escape through the perforations in the bottom, and flow into the cemented reservoir *H*, *H*. The receiver is slightly elevated, and the reservoir is connected by an arch constructed in the brickwork forming the back of the closet marked *s*, *s*. The part marked *H*<sup>1</sup> is for the convenience of dipping the purified urine from the said reservoir; thus it will be seen that this department of the closet is adapted for the use of females, and intended only for the deposit of urine. 25 30 35

The section, Figure 6, is adapted for male and female use, the receiver *I* being for urine, which receiver I prefer connecting by a



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waste pipe suitably placed that its contents after being purified may flow into the reservoir H and H<sup>1</sup>, whilst the fœces is deposited in the cemented reservoir marked J, J, which (as stated at H, H,) is connected by the brickwork being formed into an arch, and is isolated from the  
5 reservoir in which the receiver I is placed by the slanting corrugated plate of galvanized iron (or other suitable material) marked *t*, *t*; but if preferred brickwork may be substituted instead. The fœces as deposited fall into the reservoir J, J, by being first deposited into the galvanized iron pan principally shown in section marked K, the  
10 lower or delivery part of which is fitted with a valve shown in a separate view at Fig. 7 (drawn to a quarter scale), which valve may be acted on by a lever working on a fulcrum secured to the back of the pan K, not shown, but the normal position of the valve is to be closed, so that the fœcal deposit may lie on it.

15 In the hopper L my deodorizing compound is placed, and descends through the funnel *u*, but to which funnel just above the seat (marked M, M,) or otherwise I apply a compound valve (shown also in an enlarged or half sized view at Fig. 8), which valve has the effect of measuring the compound that escapes, the supply being  
20 cut off when the desired quantity has been delivered, so that the user (after use) will open and close this valve, which will distribute on the fœces deposited a charge of my deodorizing compound before the fœces is allowed to descend into the reservoir J by opening the valve shown in dotted lines at *v*, as before described, thus the fœces are commingled  
25 with the deodorizing compound as deposited; but instead of operating on the lower valve *v* by a vertical lever attached to the back of the pan K, as before stated, this valve may be worked by the action of the closet door, and to prevent waste of the deodorizing compound the valve that regulates the supply may be actuated by the action of the  
30 foot applied to a lever conveniently placed in the step in front of the seat marked *w*, or by other suitable means; thus the fœcal matter will not only be deodorized, but will become a solid mass, and be neither offensive or disagreeable of removal (which applies to other animal refuse).

35 This intercepting principle will be found highly beneficial for a sanitary closet system in thickly populated districts; but in positions where the urinal and fœcal deposits are conducted with other matter and effluent water into the common drain or sewer, I purpose applying



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at the outfall a suitable series of reservoirs and filtering tanks carried to any desired depth, by which my system of upward filtration may be carried on, and by charging my filtering tanks with my deodorizing and purifying compound all organic and offensive matter will be deposited and absorbed in the carbonaceous compound through which 5 it permeates, so that it becomes thoroughly pure before escaping to the neighbouring river or watercourse.

The collection, preparation, and manufacture of my powerful absorbing and purifying carbonaceous powder is obtained in the manner herein-before described; but having at present only prepared 10 it in comparatively small quantities, I have not thought it necessary to exhibit any particular mode of fermenting, drying, and burning or calcining the said refuse mass of which my deodorizing absorbing compound is composed, but which compound when so used as herein described and exhibited in the urinal receivers, fœcal deposits, sink 15 purifiers, as also at the outfalls of any sewage system, in each case becomes largely mixed with organic matter, which being collected in large quantities from the filtering vessels connected with domestic sinks, cattle sheds, piggeries, stables, urinals, or other receptacles in which my deodorizing powder has been used becomes largely impreg- 20 nated with organic or other gross matter valuable as manure, and such compound matter being prepared partly by evaporation, partly by absorption (by the admixture of any addition of my deodorizing powder, which of itself is a powerful manuring stimulant), and partly by fermentation of kiln drying, I am enabled to utilize this gross refuse 25 matter as a valuable regenerator to the land by giving back to it its natural stimulant, which I effect by preparing and reducing such compound to a powder for distributing over land, according to its nature and requirement, and of various degrees of strength, as fœcal matter connected in the manner herein-before described by my inter- 30 cepting principle from closets or privies will have much stronger regenerating power for the land than the refuse matter collected at the outfall of any system of sewage through which great quantities of water are always flowing.

And lastly, I have found my deodorizing powder valuable for the 35 preservation of ripe fruit, and other articles intended for food requiring to be packed for transportation, as it not only fills up the vacancy



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unoccupied by the eatables so packed, but it excludes the action of the atmospheric air.

Having thus given a general description of my Invention, and the manner in which the same may be variously carried into effect, 5 according to requirements or position, I wish it understood that the whole description, details, and Drawings may be variously arranged and extended without affecting the spirit of my Invention.

In witness whereof, I, the said Daniel Wilks, have hereunto set my hand and seal, this Twenty-seventh day of November, 10 in the year of our Lord One thousand eight hundred and seventy-five.

DANIEL WILKS. (L.S.)

Witness,

JAMES S. COCKINGS,

15 Patent Agent,

Ann Street,

Birmingham.

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LONDON:

Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,  
Printers to the Queen's most Excellent Majesty. 1875.















FIG. 5.

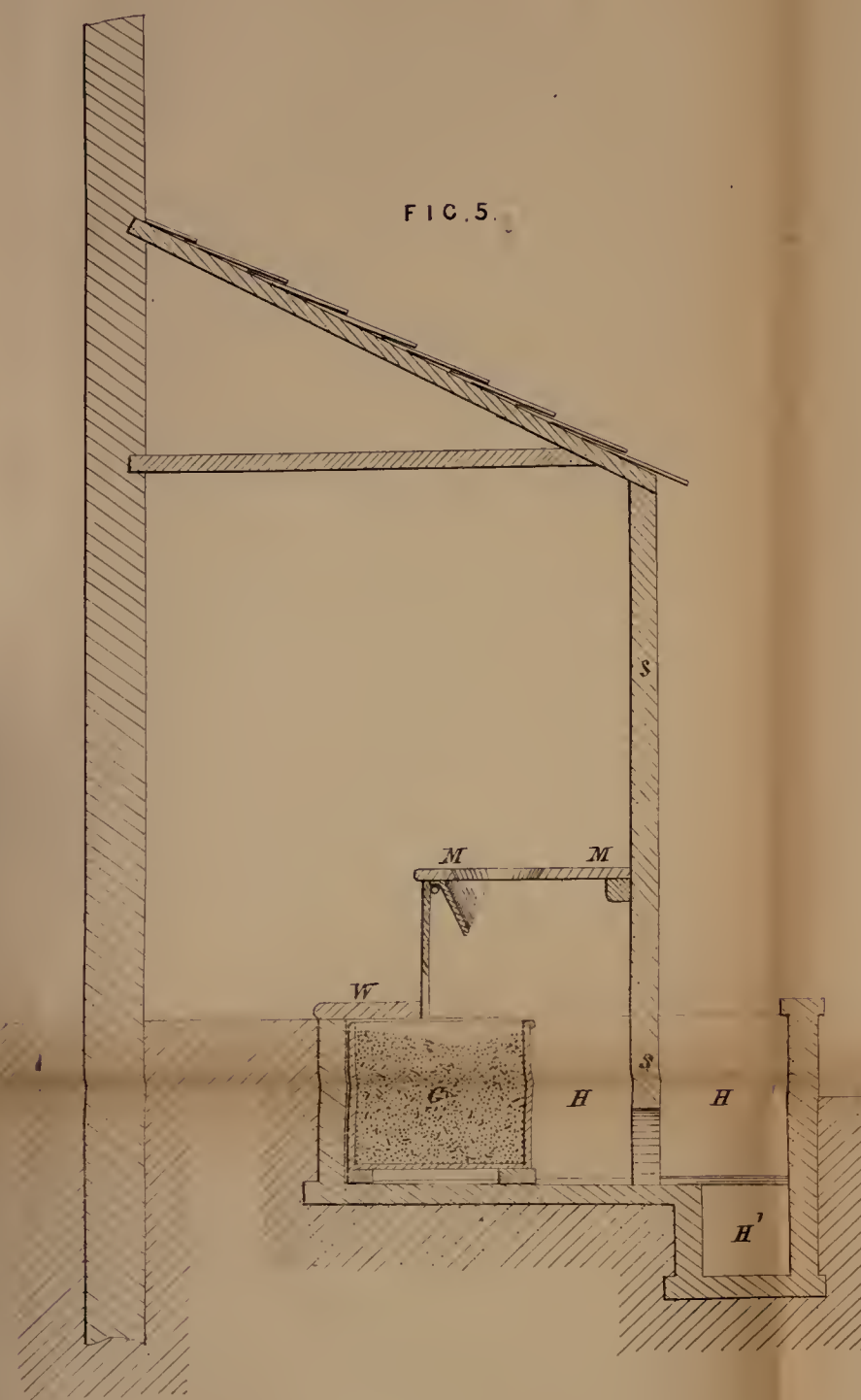


FIG. 6.

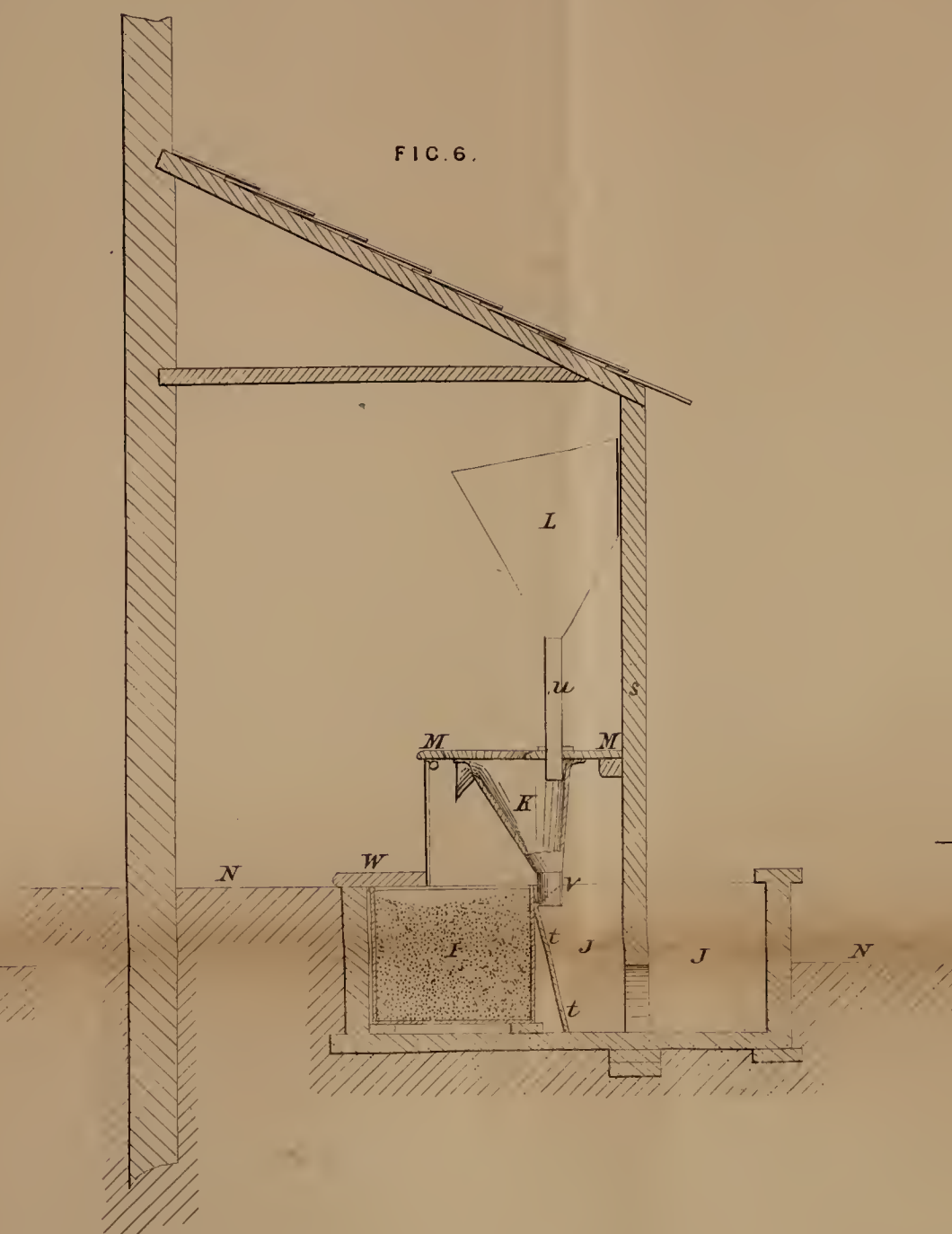


FIG. 4.

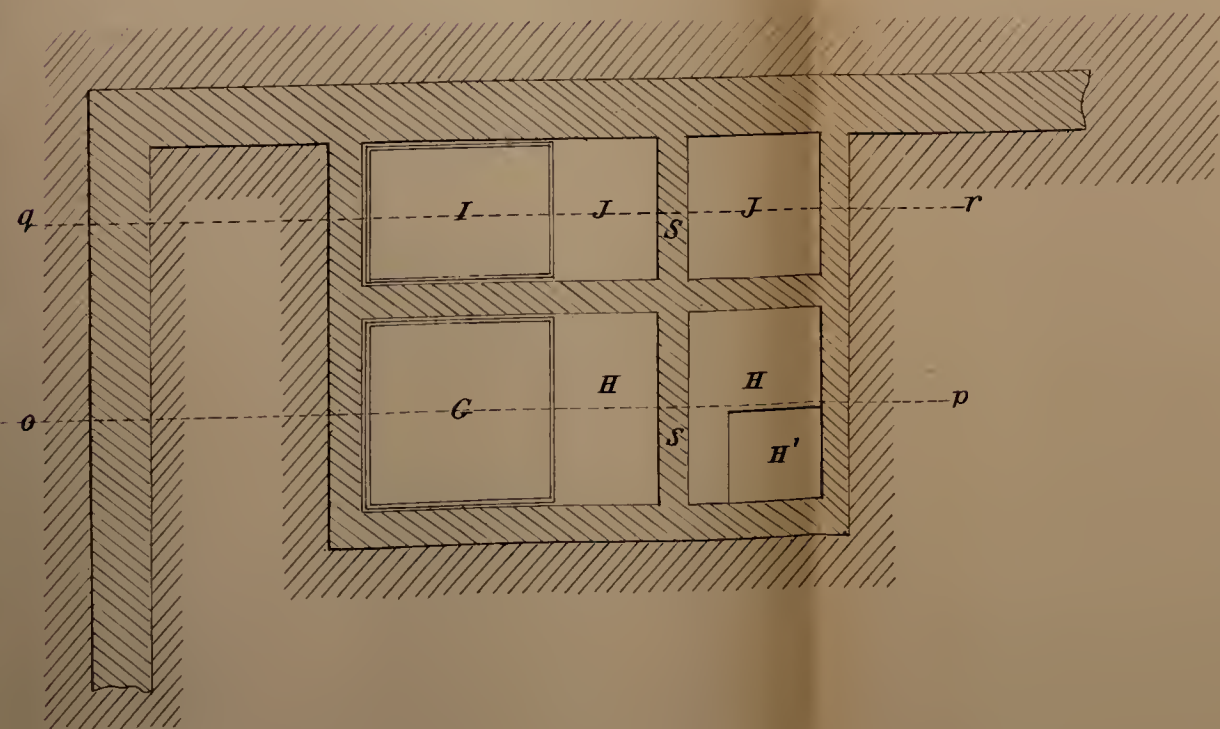


FIG. 3.

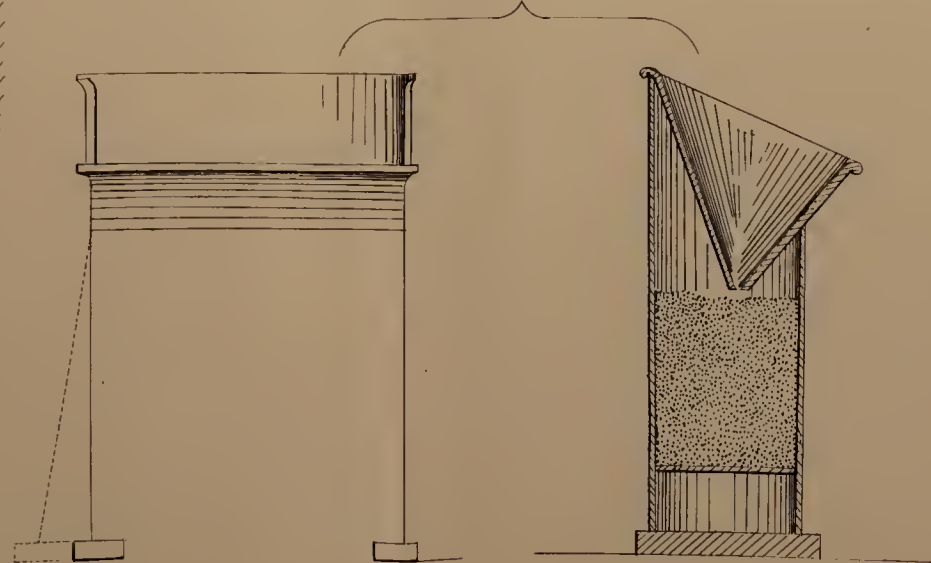


FIG. 1.

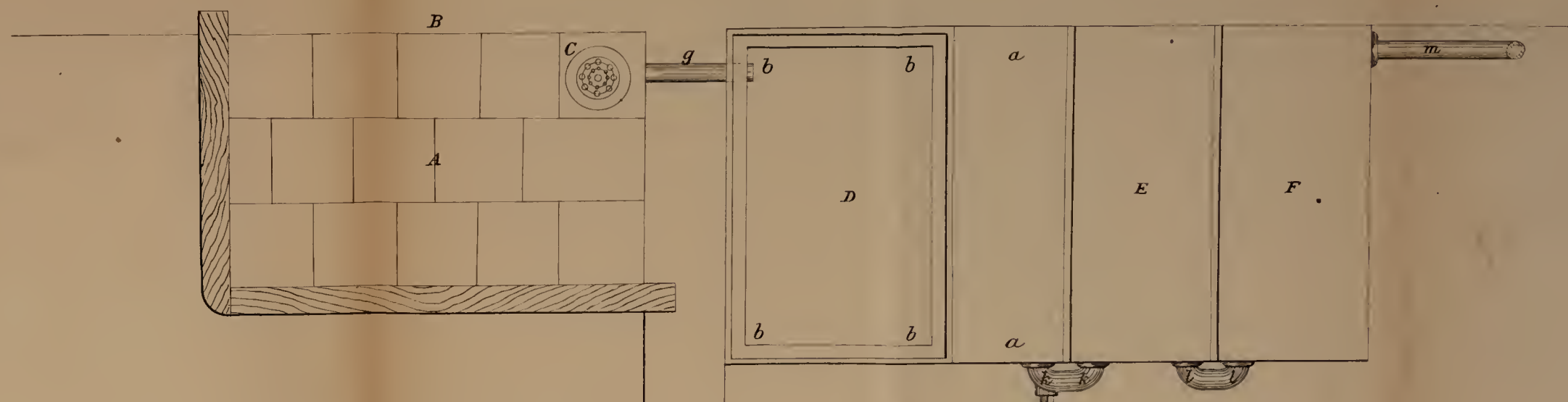


FIG. 2.

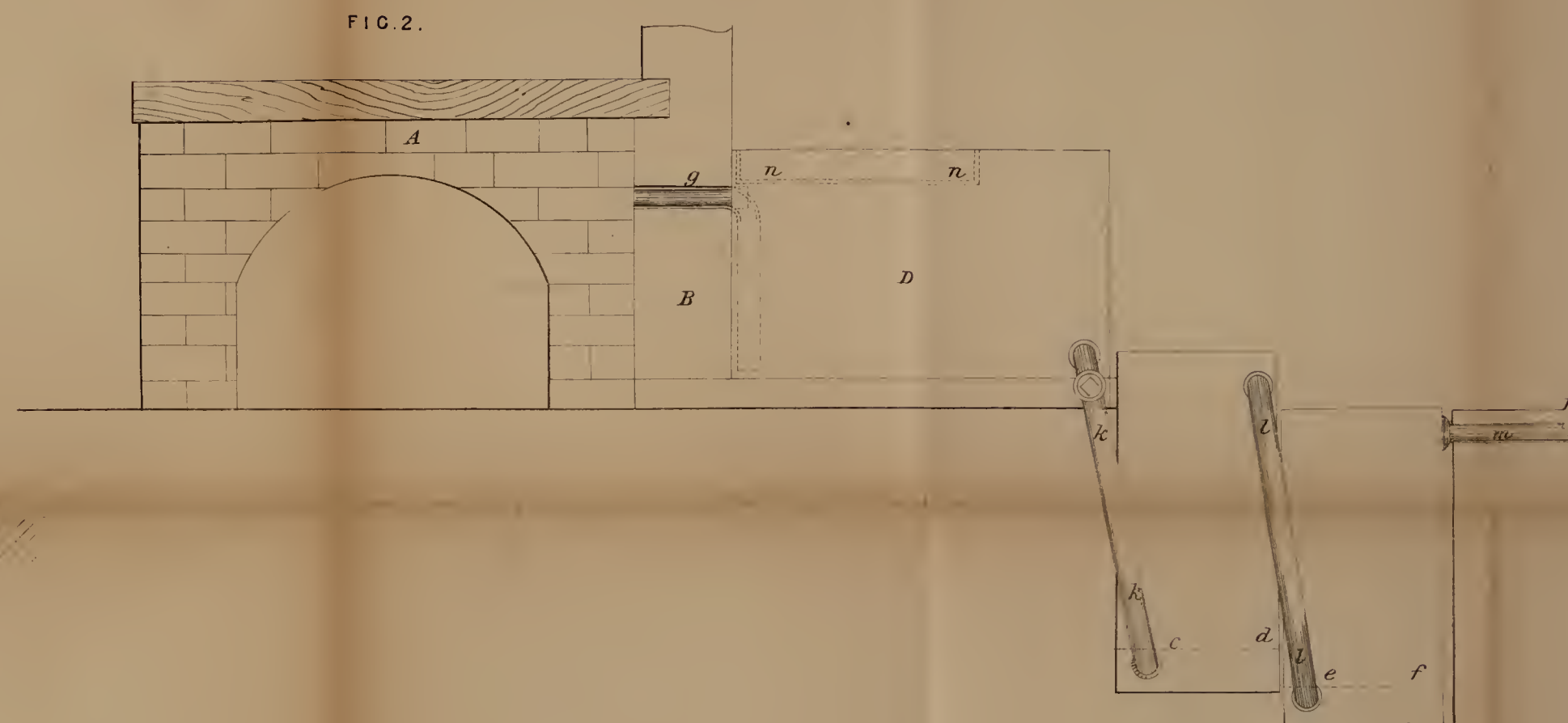
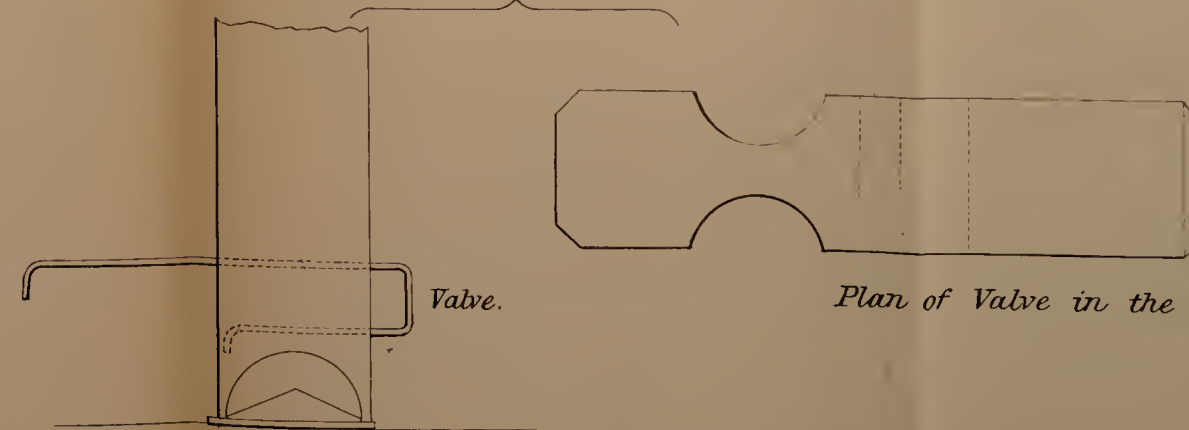


FIG. 8.



Valve.

Plan of Valve in the flat.

FIG. 7.

